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A BRIEF SKETCH OF THE RED OR PRECIOUS CORAL.

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"The capture of marine products for food or for commerce has in some cases been carried on for centuries before science stepped in to ascertain their nature, map out their life-histories, and indicate the true course for legislative interference. The fishing for the red coral of commerce in this respect agrees with that for the food-fishes. Both had been carried on for centuries before they attracted the earnest attention of the scientific, and both are examples of the long-continued prevalence of error, and, in the case of the fishes, even culpable lack of knowledge about a food-supply so important. Indeed, the application of science to the problem of the food-fishes is of much more recent date than that of the coral of commerce, just as if personal adornment and not practical utility were of primary importance in the world."*

From one point of view there is, in the scientific history of the two fisheries, certain elements in common which cannot but strike the thoughtful observer, and though in the one case they assume the form of dogged adherence to preconceived and erroneous interpretations, and on the other consist of a choice of crude beliefs often interwoven and warped by political exigencies, yet in both the same obstinate refusal to accept the scientific position is manifest.

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* 'Resources of the Sea,' p. 11.

The older writers made no fanciful remark when they stated that, with the exception of pearls and ambergris, no product of the sea was fraught with greater interest than the red or precious coral of commerce. Its early history is obscure, but it is stated[*] to have been an important article of trade with the Gauls, who decorated their weapons and helmets with it. About the beginning of the Christian era, however, the commerce in coral between the Mediterranean and India seems to have absorbed so much of the attention of the enterprising merchants that, Pliny observes, it was even rare in the regions which produced it. The natives of India considered this coral was endowed with mysterious or sacred properties,[†] and that its wearer was protected from all evil, and that it was a cure for sterility; nor need we think them specially superstitious when we remember the tiny bags of camphor suspended from our necks in childhood.

The citizens of ancient Rome again hung it round their children's necks as a charm "to preserve and fasten their teeth," and to save them from "falling sickness": and in Italy even now the wearer is protected from the "evil eye," and is cured of certain maladies, while at the same time it prevents the skin of the neck from being chafed.[‡] Gansius, further, lauded it as a preservative from the effects of thunder, the shade of Satan, a fertilizer of the field, and, when worn round the neck, a cure for gastric pains and many other ills.[§]

The economic aspects of coral (*Corallium rubrum*) thus for ages formed the sole attraction to mankind, its very origin being shrouded in mystery. At one time it was considered a petrifaction, a red plant turned into stone by the touch of the Gorgon's head or hand, and valued by the Persian as a talisman, which, in the hour of triumph, purified the hand which had shed blood. It was, moreover, supposed by such as Ovid, Sextus Empiricus, and Boyle to be soft in the sea, and to be only solidified by contact with the air. Theophrastes, a disciple of Aristotle, Dioscorides, Pliny, Cæsalpinus, Ray, Geoffroy, and Shaw con-

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[*] Encyclop. Brit., article "Red Coral," ninth edition, 1877. See in this connection an interesting Address by Prof. Hickson on "Precious Corals," 1905, Manchester Microsc. Soc.

[†] *Ibid.*

[‡] Simmonds.

[§] Other maladies in which red coral was used are given by Prof. Hickson, *op. cit.*

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sidered it to be a plant, but they knew not its origin or formation. Ferrante Imperato also concluded that its vegetable nature was evident, and Tournefort placed it amongst the stony marine plants. Rumpf, however, from his practical acquaintance with marine organisms, took a different view. This opinion was further strengthened by Boccone's observation of the milky juice in the living structure, and by Marsigli's discovery* of the pale flowers, resembling cloves in shape, which appeared on its surface. Boccone (the Sicilian), however, resiled from his original view, and by-and-by combatted the notion that it was a plant. Guisonæus, a physician of Avignon, in his letter to Boccone, affirms positively that red coral is only a mineral, composed of much salt and a small quantity of earth, while its form is given by precipitation, like that of the *arbor Dianæ* of the chemists. Swammerdam, the celebrated *savant* of Holland, held similar opinions. Dr. Woodward considered red corals were stones, from their exceeding hardness and specific gravity, and especially by observing that when calcined they were converted into lime. The distinguished Réaumur at first thought the independent central hard part was a concretion, whilst the enveloping softer rind was the plant. He declined to believe that the whole was formed by the so-called "insects," but he subsequently, along with Bernard de Jussieu, after an examination of living polyps of various kinds on the shores of France, wholly altered his opinion.

As an example of the views in our own country about the beginning of the eighteenth century (1705), Mr. Anthony van Leeuwenhoek, F.R.S., may be cited.† He held that blood-coral did not grow, but was coagulated on shells. It lost its colour by heat, was not dissolved by either hot or cold water but was so by acid (*aqua fortis*), that its hardness arose from the great number of its fixed salts, and that it was composed of particles which puzzled him greatly. He also assured himself that coral can be of no manner of service—as physic—to the bodies of men, "unless it were to amuse common people with uncommon medicines, and thereby get themselves (that is, certain physicians) a name, whilst they are in the meantime only cheating the world, of which we have so many examples."* Leeuwenhoek apparently could not satisfy himself as to whether the coral was an accretion or a plant, being confused by the particles forming the mass of the dried structure.

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* 1706. 'Histoire Physique de la Mer.'

† Philos. Trans. 1708–1709, pp. 126 *et seq.*

Thus halting between a petrifaction and a plant, the position of red coral was uncertain. About the beginning of the eighteenth century, however, a talented young French surgeon, Peyssonnel, who had been initiated into the study of marine organisms by Marsigli, and who was acquainted with the views of the older authors in regard to anemones and other plant-like animals, formed a very different opinion, and by a careful study of the coral in a living and fresh condition, he discovered that it was the formation of polypes. A native of Marseilles, and a student of marine zoology from early days, he qualified in medicine, and subsequently found opportunities to pursue his researches on red coral. His familiarity with sea-life during various voyages to America, St. Domingo, and Egypt enabled him to join the rough coral fishermen in their boats on the Algerian coral-grounds, which had been known to the Pisans in the tenth century.

Fully aware of what his master in zoology, Count Marsigli, had discovered, *viz.* the flowers of the so-called coral-plant, Peyssonnel, as soon as the coral was brought by the fishermen near the surface, plunged a jar into the water and inserted several branches. After some hours he noticed white points over the surface, corresponding to the holes which pierced the outer covering or so-called bark. Gradually expanding, these points assumed a radiate structure, each somewhat resembling the flower of the clove, as described by Marsigli. Continued study of these structures convinced Peyssonnel that they were truly coral "insects," each of which he termed *urtica, purpura*, or polype, and which expands itself in water, and contracts itself in air or when irritated. He thought that each polyp issued from its cavity or cell in the bark, while in the tubes were the organs of the animal, the glandules being the extremities of the feet, and the whole containing the liquor or milk of coral, corresponding to the blood and juices.

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* Philos. Trans. 1708–1709, p. 134.

Before Peyssonnel gave full descriptions of the polyp and its physiology he had an opportunity of studying the polyps of a madrepore, which he says are much larger and more easily examined. Each is placed in the centre of a pore, and causes the structure to increase in every direction by lifting itself further and further from the centre of the stone. Each deposits a liquor which runs along the furrow, becomes hard, and causes the coral to increase proportionally in every direction. Corals, therefore, are truly zoophytes, formed by the labour of the animals which inhabit them.

Some of his views, as might be expected, were crude. Thus he supposed that corals produced spawn enveloped in a viscous substance, which fastens to rock, glass, broken earthenware, and stones. The egg is duly hatched, and furnishes the animal which resembles the sea-polyp. It is now known that the egg is developed internally, and that a ciliated larva issues from the mouth of the polyp. He also erroneously imagined that a particular tube (gut), which in the cuttlefish secretes ink, in this case secretes matter which hardens into the dense axis of the coral. Nature, he quaintly says, had furnished these animals with claws (tentacles), which seize their prey as it passes, and thus they are nourished.*

He described two kinds of apparatus used in coral-fishing—one for smooth ground (same as described by Gassendi in his life of Peyreskius), the other, the *salabre,* where the bottom is rocky. Peyssonnel found that coral grew amongst the rocks and in the caverns plentifully in ten to twelve fathoms of water, but also as deep as one hundred and twenty fathoms. He cites the coast of Barbary, which lies open to the north, as a proof that coral flourishes there as well as in southern exposures.

When Peyssonnel's observations were first communicated to the French Academy, they were received for the most part with incredulity and opposition. There was little sympathy, indeed, with the young surgeon who had so loyally stood by his father, whose devotion to his fellow-citizens during the plague cost him his life, and whose own discoveries were an honour to his country. He received from the King, however, a mission to explore the shores of Barbary, and was thus enabled to forward additional observations to Paris. These, while giving rise to fresh discussions and renewed combats in the Academy, caused some, such as Flourens, to perceive the importance of Peyssonnel's discovery. Three members of the Academy, moreover, after personally investigating the subject, ranged themselves on the side of Peyssonnel, *viz.* Bernard de Jussieu, Réaumur, and Guettard. Their notions, however, of the relation of the polyps to the solid axis of the coral were inexact, especially those of Réaumur, who compared the coral to the bee and its cells. Fresh opposition was thus engendered to Peyssonnel's views, for which he was not responsible. These memorable discussions, however, decided by-and-by the position of the red coral. Henceforth it was admitted to be a product of animals. Yet here and there doubts subsequently appeared. Thus Donati,* an Italian naturalist, attempted to unite the diverse views of Marsigli and Peyssonnel by asserting that red coral showed the vegetation of a plant and the propagation of an animal, therefore it should be placed in an intermediate position. This author gives a fair account, with figures, of the polyps with their pinnate tentacles, and of a section of the axis and cænosarc of the corallium. He appears, however, to have been unable to shake off preconceived notions.

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* Justice is done to Peyssonnel both by Milne-Edwards in his Hist. Nat. des Coralliaires, Suites a Buffon, 1857, and by Lecaze Duthiers in his Hist. Nat. du Corail, 1864. The former gives interesting quotations from the manuscript of Peyssonnel preserved in the Library of the Museum of Natural History, Paris.

Such views, however, and those of Dr. Parsons in the 'Philosophical Transactions'† to the effect that, though Peyssonnel did find animals on the coral, it need not be concluded that they constructed it, gradually died away, and the investigations of Cavolini (1785) and Milne-Edwards on the one hand, and the more recent work of Lacaze Duthiers on the other, did justice to the researches of the young French surgeon and naturalist.

Peyssonnel was thus the discoverer of the true nature of coral, and he resolutely defended his views against the French *savants*. Disgusted, however, at the reception his labours met with, and the absence of all encouragement in his zoological studies, he accepted the post of physician-botanist to the Island of Guadaloupe, and never again entered France or sent a paper to the Academy. His completed researches, indeed, were communicated to the Royal Society of London, and did not appear in French. As Lacaze Duthiers truly says, he merited other treatment from his countrymen. His devotion during the plague at Marseilles,* his enthusiasm and courage in encountering danger and fatigue during his explorations of the African coast, and his discovery of the nature of coral ought to have assured him a distinguished name. He was one of the band of surgeon-naturalists (to whom allusion has more than once been made) who have done so much both at home and abroad for the progress of zoological science, yet whose labours and whose influence have escaped the just consideration of the late University Commissioners for Scotland. Though by statutory injunction the future medical graduate must write a thesis on a purely medical subject, and not on a zoological or a botanical one—a freedom which his predecessors enjoyed—it is unlikely that the indissoluble brotherhood between these two subjects and medicine will heed either appreciation or sympathy. In the future as in the past the ranks of medicine surely will produce men like Peyssonnel and Rigaut, Rondelet, Kölliker, Ehlers, William Harvey, Alex. Monro, Erasmus Darwin, Sir Hans Sloane, John and William Hunter, John Goodsir, John Reid, George Busk, W. B. Carpenter, John Hutton Balfour, G. J. Allman, James Syme, Joseph Hooker, Richard Owen, Thomas Huxley, William Flower, William Turner, George Johnston, Albany Hancock, Robert Grant, Alex. Dickson, G. S. Brady, J. B. Pettigrew, Alleyne Nicholson, Robert Edmonstone, and many others, whose services to medicine and to zoology and botany have been and are an honour to their respective countries.

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* 'Della Storia Naturale Marina dell' Adriatico, Venezia, 1750,' p. xliii, tav. v.

† 1751–1752, p. 505.

The red or precious coral, then, frequents a rocky bottom on the borders of the Mediterranean and its islands, and is most abundant at depths from twenty-five to fifty fathoms, but may extend to about one thousand fathoms. Its distribution in quantity is indicated by the titles of the various fisheries. Thus it occurs on the shores of Southern Italy, off the Island of Ponza, in the Gulf of Gaeta, off Sicily, especially at Trapani at its western extremity, off Corsica and Sardinia, in the Straits of Bonifacio, off the Mediterranean shores of France, at Marseilles and Provence, off Catalonia, off Tunis, Algiers, and the shores of Morocco, as well as the Ionian Sea, and Cape Verde Islands in the Atlantic. Other species of corals come from the Mauritius and Djilolo.* "The valuable pink coral is found chiefly off the coast of Sicily. In the year 1875 a bed was discovered in the Straits of Messina, in which the coral, though found only in small quantities and of small size, was of immense value, owing to its beautiful uniform pink colour, and without any of those stains which detract so much from its worth. The coral found in this place was sent chiefly to London and Birmingham. Its value is from £80 to upwards of £200 per ounce."† The supply of this coral, however, was of short duration. It is usually attached to the under surface of stones and rocks on the so-called banks, which the coral fishermen (corallini) find with remarkable skill; indeed, Lacaze Duthiers says they are as well acquainted with these as with the islands which rise above the sea. Moreover, it would appear to flourish better where the bottom is muddy than where it is clear or sandy. By its base it clings firmly to stones, rocks, and other surfaces, penetrating the small crevices, and often having various growths such as Polyzoa and Melobesia externally, while occasionally it envelops a shell (*Thecidium*), a sea-acorn (coral-tulip), or a piece of wood.

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* He wrote a youthful memoir on the contagion of the plague, for which the Academy made him a Correspondent.

Coral varies in appearance, some specimens being larger and more branched, others shorter and less branched, age having a considerable effect in modifying its aspect. Rarely are the branches regular, since accidents of various kinds and the death of parts occur. Its hard axis is capable of taking a fine polish, as also is that of certain allied forms such as *Pleurocorallium*.‡

Most authors who have examined it in life have had considerable difficulty in carrying out their wishes—from the days of Peyssonnel till now—for the boats are often a long time at sea. Their owners are somewhat suspicious of strangers on board, both in connection with the coral itself and the distraction of the workers, while a certain amount of secrecy still haunts the pursuit. Moreover, the trials of such a life are not few. Even with every advantage it is by no means easy to secure specimens that will live, for the tangles and other instruments of capture inflict injuries which in warm weather prove fatal. Lacaze Duthiers was most successful by selecting uninjured specimens on stones, and suspending them in vessels of sea-water.

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* See Hickson, Camb. Nat. Hist. vol. 1906, "Cœlenterata," &c., p. 352.

† Greck & Co., *in litt.* to Prof. Moseley, 'Nature,' March, 1882.

‡ J. Yate Johnson, Proc. Zool. Soc. 1899, p. 57.

Like all the members of the group *Alcyonaria*, to which red coral belongs, the polyps on its surface have eight pinnate arms, but instead of being red, or, as some of the older authors called them, "flowers of blood," they are pale and transparent. When contracted the surface of the coral is dotted with little elevations marked by deep radiate grooves, and from each of these, in sea-water, a polyp by-and-by expands. These polyps of the red coral were the flowers of Marsigli,* and about which, in the earlier days of Peyssonnel's discovery, so many opposing views were broached. The hollow, pinnate tentacles (with thread-cells) surround the mouth, which is in the centre, being ciliated, and send currents of water (bearing food) into the digestive system. Around the latter are eight radiating lamellæ (mesenteries) and other organs. The polyps, moreover, are dimorphic (autozoids and siphonozoids, the latter without ova or generative organs). These polyps thus resemble those of the common *Alcyonium digitatum*, the "dead men's fingers and toes" of the fishermen, yet it is remarkable that in a country of marine zoologists like Britain scarcely a single figure representing these beautiful polyps in their natural condition exists, for Prof. Hickson does not figure a fully expanded polyp in his excellent brochure on *Alcyonium*,† whilst the figures of the expanded polyp in his finely illustrated Memoir‡ also lack the beauty of the perfectly healthy example. Prof. Hickson, indeed, explains that when at Plymouth he never succeeded in getting *Alcyonium* to expand to his satisfaction, even the figure in the recent Cambridge Natural History (1906) being indifferent, for it apparently has been taken from a specimen by no means vigorous, and the striking differences between the fully expanded polyps and the shrunken apertures into which they have disappeared lack tone. It is rare to find one collected by hook, dredge, or trawl in a satisfactory condition—indeed, such has never been seen. The only method of securing a perfect example is, as stated in 1864,* by searching for small specimens near low-water mark under stones, chipping them carefully with a basis of stone, and at once placing them in sea-water. Thus a patch three-quarters of an inch in diameter contracted to one-tenth of an inch in thickness. "As the polyp contracts into its stellate aperture its mouth gapes, apparently the more readily to give exit to the water in its interior. It presents the aspect of an octagon with hollow sides when about the level of its cell. Rows of spicula project from the corners towards the centre. If further extended the tentacula, their pinnæ, and the rows of spicula become more apparent; oral aperture dilated; outline of oral disc similarly octagonal, though much larger. When still further extended, coiling of the arms is frequently seen, like the circinate vernation of the ferns. In a state of full expansion the polyp is elongated and narrowed toward the head, measuring more than half an inch from the tips of the tentacula to the base. The tentacles can be stretched to more than twice the diameter of the oral disc, are narrow and tapering, and have the elongated pinnæ at each side; the tips are slightly opaque, probably from minute suckers. The tentacles are also rendered rough by minute spicula, which do not, however, go further than the base, where a pale non-spicular portion occurs; below this the neck of the polyp is supplied with long tuberculated spicules, arranged in an arrow-like manner. In those polyps which are best expanded the diameter of the oral disc is smallest. Sometimes, from the position of the parts, the tentacle with its pinnæ presents a spindle-shaped appearance."† The spicules of the tentacles appear to have had but little attention paid to them, though they are figured by Prof. Hickson in his Memoir (vol. 37, fig. 10), and alluded to on p. 370.‡

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* They essentially differed, however, as Lacaze Duthiers pointed out, for when touched they contract.

† L. M. B. C. Memoirs, v. 1901.

‡ Quart. Journ. Micros. Sc. vol. xxxvii. pls. 36 and 37.

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* Proc. Roy. Soc. Edin. vol. v. p. 393, 1862–66.

† An accurate drawing of this example by the late Mrs. Günther is given in 'The Marine Invertebrates and Fishes of St. Andrews,' pl. vii. fig. 8, 1875.

‡ *Op. cit.*

The fleshy external part (cœnenchyma), in which the polyps are placed, is canaliferous, has spicules, which are, according to Ridley, of one type, "*viz.* a hexahedral oblong form, the angles being formed by broad truncate but microtuberculate tubercles which preserve the chief features of their characteristic form throughout all varieties of the external form of the coral."* It surrounds the dense, inflexible, calcareous axial part (the coral of commerce), which consists of fused spicules formed by the fleshy part, and it is stated to be devoid of an investing cellular (epithelial) layer, whereas *Gorgonia* and its immediate allies have the latter, the central rod in these being ectodermal. Cavolini compared the fleshy and the hard parts to periosteum and bone—a somewhat crude simile—while Boccone thought the hard axis was only formed by juxtaposition.

The vessels ramify through the whole of the fleshy part, the larger parallel ones next the hard axis, the smaller forming a reticulation throughout the entire layer. They carry a nutritive fluid originating in the chyne in the interior of the polyps, as clearly described by Peyssonnel. It is the so-called "milk" of coral. The fleshy part is translucent when distended by water, is cellular, and has the calcareous spicules already mentioned. Externally is the cellular ectoderm, which by fusion of its cells appears as a structureless layer. The fleshy part has a tendency to produce buds everywhere, even injuries being followed not only by repair but by branching.

The sexes of the red coral are generally borne on separate colonies; rarely both occur on the same branch. No external distinction exists between them, except that in dead branches the eggs become yellow, whereas the products of the males remain milky. Both elements are produced in the sarcosome in the deeper parts of the polyps, as in *Alcyonium*. The eggs are developed internally, and the larva escapes by the mouth (as a planula) from May to September, and occasionally as late as December. A close-time, therefore, could only be carried out by the division of the entire coral-bearing area into sections. The larva swims freely in the water, and becomes pear-shaped before fixation, sinks to the bottom, fixes itself to stone or rock, and becomes flattened.

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* Proc. Zool. Soc. 1882, p. 228.

The rate of growth is still uncertain. Some assert that coral grows with tolerable rapidity, and that articles thrown into the sea will in a few months be studded with small specimens. Others, again, hold that it takes twenty years to produce an axis as thick as the forefinger.

Previous to the sixteenth century the coral fishery was controlled by the Italians; thereafter for a short time it was in the hands of the Spaniards; then the French held it till 1793, the centre of the trade being Marseilles, when the Revolution threw it open. Though the British Government took charge of the fisheries for a short time (1806), the industry since that period has been mainly Italian.

The coral fishery is carried out in decked boats of two sizes, *viz.* six and fourteen to sixteen tons. The former are chiefly French, though manned by Italians; the latter Italian, mostly from Torre del Greco, where the inhabitants are nearly all engaged in this fishery, either as fishermen or manufacturers of coral brought on shore. Smaller boats without a capstan are also used by the Spaniards, and with only three or four men on board, whereas the former have respectively six and ten or twelve men. Many of the men come from the coast of Tuscany, a few are Genoese, most are Neapolitan, and more especially from Torre del Greco (near the foot of Vesuvius). No French crews will undertake the work. In the large boats is a captain, a second in command, and eight or ten fishermen. The best fishermen get from four hundred to five hundred francs for the six summer months. The greater number get from two hundred to three hundred francs.* The fishing season is from March till October, but weather permitting it may be prosecuted at all times. Whilst the food of the men consists chiefly of biscuits and water, Italian pie, and a few vegetables, their muscular exertions are very great as well as long-continued, since they work night and day—often in the broiling sun of the African shores—relieving each other in shifts of six hours. The hardships of the life are, indeed, a byword.

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* Simmonds ('Commercial Produce of Sea') says from £20 to £24, and the masters twice as much. See also 'Nature,' vol. 25, p. 511 (March 30th, 1882), for a letter from Messrs. Greck & Co., describing the Italian coral fishery.

Each boat is provided with an apparatus or engine formed of a cross of wood, a metre long in the smaller, and two metres in the larger. Sometimes an iron centre is used with sockets for the arms. The latter are made of stout wood, and in the centre (when no iron is present) is a large stone, while a series of tangles made of hempen ropes and pieces of net are attached to the cross. The tangles are about a yard or more in length, and, in the larger boats, from twenty-eight to thirty in number. Under the central stone is often a circlet of six or eight tangles, which the fishermen call "the tail of Purgatory." The main rope passes from the centre of the cross, and is protected from friction by a sheath of lashing, and shorter ropes connect the beams to the central one so as to increase the strength of the apparatus.* The Spaniards use a perforated iron instrument with teeth, and a bag of net to entangle the coral, but no special advantage is gained.

When the captain thinks the ground is suitable he launches the engine, the sails (lateen and jib) are trimmed, and the capstan put in action. The cross of wood fixes on rocks and stones, breaking off the coral and overturning the latter. Pulled on by the rope it advances by jerks, the horizontal action of the sails being combined with the vertical action of the capstan. Now it may be necessary to give more rope or reverse the action of the boat and capstan, and again proceed, all being done under the orders of the captain, who is the stern and inflexible master of the toilsome pursuit. As the huge stones are overturned and the corals broken off, the tangles pick up the loose pieces, besides starfishes, fin-shells or sea-wings (*Pinna*), lamp-shells, and other invertebrates.

The fishermen engaged in this arduous work are naked, with the exception of drawers. When busy they chant various songs, often including the names of their favourite saints, swaying their heads and bodies to the song, and straining every muscle at their exhausting work. The work of these men thus resembles in some respects that of the eager trawlers in our waters.

Should the engine become fixed and resist all efforts to disengage it, an iron ring is sent down on the main rope to free the wooden cross, and a kind of grappling-iron (harrow) to disentangle the hemp which may have become twisted round rocks. Thus continuing their weary labours, the apparatus is hauled on deck, and an eager search is made for coral amongst the tangles. Every fragment is carefully picked out, and stored for the owner of the boat, for no one employed in the fishery is permitted to sell coral.

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* *Vide* a figure on the covers of the 'Resources of the Sea,' 1899. This was sketched from the apparatus exhibited in the London 'Fisheries' Exhibition of 1883.

Coral is separated into *Dead Coral* (or pourris), which is sold at a price varying from 5–20 francs a kilogramme (2 lb. 8 oz.). *Black Coral*, 12–15 francs per kilogramme. *Coral in case* (caisse), 45–70 francs a kilogramme (ordinary commercial coral). *Choice Coral*, 400–500 francs per kilogramme,* including rose coral and *peau d'ange* (angel's skin), off Sicily and Straits of Messina. The finest rose tint is worth £120 per oz. Rare kinds of pale tints are worth twenty times their weight in gold (Simmonds). It is occasionally milk-white.

The large boats are valued at £550, and their outlay averages about 11,000 francs per season. From 400 to 600 boats were engaged in 1880; in 1871 there were 460 Italian boats, valued at £80 and £160 each (Simmonds). About 6000 Italians and Spaniards were occupied on the Algerian banks in 1864. In 1873 the Algerian fishery employed 311 vessels, manned by 3150 men, and yielded coral valued at £13,000. The Spanish fishermen collect off the Cape Verde Islands about 24,760 lb. of coral = £20,000. Large boats may collect from 650 to 850 lb. of coral in the season, value from 13,000 francs to 24,000 francs. If 250 kilogrammes are procured at 50 francs it covers expenses. Foreign boats pay heavy dues for right to fish on the Algerian coast.

A diver's dress (*Scaphandre*) for the coral fishery in shallow water has been suggested, but it appears to be unsuitable. The same applies to a submarine boat. A steam capstan is a more reasonable proposal.

Coral is often perforated by sponges and annelids, besides having externally various tubes of Sepula (*Spirorbis*), and other encrusting forms. On the Spanish coast fine blood-red coral is found affected by filaments of a parasitic alga, which causes a change in the tissue. The same parasite is found on *Astroides* and molluscan shells.

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* Some of the finest from Sicilian grounds and Straits of Messina is sent to London and Birmingham, to be cut into lentils, and, as stated, is valued at £80 to £200 per oz.

The produce of the coral fishery is sold in Messina, Naples, Genoa, Leghorn, Marseilles, and the Algerian coral goes in addition to Pisa, in Sicily, and Trapani. About 160 tons are annually brought into Italy, and the articles made of it are valued at nearly £500,000. The total annual value of rough coral has been estimated at £2,000,000, while, when manufactured, it reaches £10,000,000. Great skill is shown by the Italians in sculpturing and polishing coral. The finest must be of a delicate pinkish or flesh-like hue, uniform in tint throughout, and in large pieces. "It has the hardness and brilliancy of agate, and shines like garnet with the tints of the ruby."* Inferior kinds are sold at £2 per oz., and small fragments, "collete," used for children's necklaces, at 5s. per oz. Even worm-eaten coral, of little value in Europe, goes to the East, for the natives believe that gods dwell in the little holes. Arabic coral of inferior quality is also made into simple cylinders pierced lengthwise, and sold for servants' use.

The finest workmanship perhaps is seen at Naples and Leghorn, and in the form of pearls, large and small, smooth and facetted, olives, sculptured men, animals, flowers, fruits, or rounded buttons, the largest and finest of which go to China for the Mandarins' caps. "In Leghorn about 1000 women are employed preparing 50,000 lb. of coral into little beads—round, egg-shaped, smooth, and cut into facets. The greater part is sent to India, but also to Germany and Russia."† The same author states that in 1879 Genoa had thirty engravers of cameos and coral. In all from 5000 to 6000 persons gained a livelihood in the province in connection with coral, the craft producing a revenue of £80,000. Marseilles, again, manufactures 2,000,000 francs of coral. Manufactured coral is exported to Egypt, India, Thibet, China, Britain, the European States, and America. In the latter and the West Indies the blacks have a great fancy for coral, and so in Morocco, India and Central Asia, Central Africa and America, and as in these countries and in some European States the dead carry the coral ornaments with them to the tomb, the demand is constant. In our own country coral beads and other personal ornaments are common. Between 1860 and 1870 Simmonds mentions that £300,000 worth of coral was received in Britain. Very costly articles of jewellery, indeed, may be formed from it, a single set occasionally reaching £1000. A fine piece (8 in. long), exquisitely carved and forming the handle of a parasol, was valued at £70 (Simmonds).

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* Simmonds, 'Commercial Produce of Sea,' 1879, p. 441. † *Ibid.*

The antiquity of the coral fishery, the comparative freedom in regard to working, and the exhaustion of certain banks, have led to suggestions for restriction—for instance, to make a close season during the development of the eggs—but as this period stretches from April to September, and even later, the very season when the fishery can best be carried on, the suggestion, as already indicated, is impracticable.

The fact that small quantities are procured from a bank that has been persistently fished for some time, whereas numerous and fine specimens occur on a new bank, or one that has had a long rest, point to the propriety of intermitting the work. This was further exemplified after the four years' rest of the Egyptian campaign. Lacaze Duthiers thus advised that the Algerian region should be divided into five areas, each of which should be fished in succession, after a four years' rest, so that this suggestion as applied to the food-fishes of the North Sea is not new. The conditions, however, of the two groups, *viz.* coral and food-fishes, widely diverge. The Algerian reefs, indeed, were divided into ten portions, only one of which was fished annually, ten years being considered sufficient for the growth of large pieces of coral.

Of important banks in recent times, that of Sciacca (near Sicily) may be mentioned. This was discovered in the middle of May, 1875, and large supplies attached to groups of bivalve shells or pieces of dead coral, chiefly of red or black coral, were obtained. Thus a boat with eight men collected from thirty to forty pounds a day, and it sold at eleven shillings per pound less five per cent. tare, so that each boat had a daily gain of about £20. By the middle of July the coral sold at only seven shillings per pound and eight per cent. tare, and towards the end of the month considerably less. It was estimated by Simmonds that from June 1st to August 31st, 1875, the quantity of coral sold at an average price of seven shillings per pound was 264,000 lb., or = £92,000. In the case of Sciacca about seven hundred boats crowded the beds, so that a Government ship had to be sent to keep order. Another bed was found ten miles off, and still another further removed (1880). About eight thousand tons of coral were fished on these banks, reddish and black (which Moseley supposed to be due to manganese, since he found shells elsewhere with blackish deposit of manganese). The Sciacca coral was chiefly attached to shells and fragments of corals, not to rocks and stones; depth, one hundred to one hundred and seventy fathoms. Greck & Co. say that the dark colour appeared to be due to the muddiness of the water. This coral found ready sale in English markets, being prepared for Calcutta. It was exposed for months to the heat of the sun and kept moist, when the black colour disappeared.*

Prof. Giglioli (to whom I am indebted for interesting information on the subject), however, mentions that, although this bank was worked till it by-and-by was exhausted, others were found in the same region. Thus on the banks worked from March to October, 1882, coral was procured to the amount of £179,724. There were, indeed, 582 boats and 5766 men on the area. Moreover, it was chiefly dead coral, and sold at a low price.

Between the years 1880 and 1883 much coral was got on the extreme edge of "Adventure Bank," not far from Graham's Island (Ferdinandea), and principally in three patches. It was, however, dead and blackened, probably from the volcanic eruption which caused the island to appear and disappear in 1831.

The fact that no minute survey of the Mediterranean has been made, so as to map out the rich coral-banks with their fauna and environment, and that no very accurate statistics have been kept of the captures from year to year, show that great caution is needed in drawing deductions.

Recently a species of coral (*C. johnsoni*), which is known off Madeira, was dredged in 388 fathoms about sixty miles off Eagle Island, on the west coast of Ireland, where so many rare forms have been procured under the skilled auspices of Mr. Holt, Scientific Adviser to the Fisheries Department."[*]

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* *In litt.* Messrs. Greck & Co. to Prof. Moseley. The most recent account is that of Canestrini, 'Il Corallo, Monografia,' 1883.

An artificial substitute—coraline—is used for cheap jewellery, but the beads are too regular, smooth, and uniform in tint to pass for the genuine article.

A story is told by Simmonds of certain distinguished foreigners who admired a string of large coral beads in a shop in London, but expressed astonishment at the high price. Some time after they visited the same shop and expressed indignation at the imposition attempted to be practised on them, since they had purchased a similar article for one-tenth of the price. They were asked to put the two articles to test with a knife. The true coral was uninjured, but the artificial composition splintered. An appeal to a law court for redress of the fraud was the result.

Ivory beads are also sometimes dyed to imitate coral (Simmonds).

On the Pacific coast of Japan rocky coral banks of great richness were known in the seas of Tosa long ago, and coral was occasionally taken off the coast of Tsukinada in early times. In the time of the Daimyos, however, the fishery or sale of coral was prohibited lest the Daimyo of Tosa might be compelled to hand it over to the Shogun. The grounds off Tosa are the oldest in Japan, and include the Muroto, Tsukinada, and Kashiwajima grounds, and they range from 90–180 metres in depth, and are often very rough. The second or Hizen ground is both the most extensive and the most profitable, and it lies about 65 km. S.S.W. of the Goto Islands, and is from 55–180 metres in depth, both rough and smooth ground being found. The third area is the Satsuma ground, including the small banks to the south of the Koshiki Islands, and was recently discovered. Prof. Kishinouye describes seven species of *Corallium* from Japanese waters: viz. *C. japonicum*, the most abundant, is known by the name of "Aka-sango."[†] It comprises two-thirds of the annual proceeds of the commercial fisheries in weight, or from 4000 to 10,000 kilos. The axis (skeleton) is dark red in colour with a white centre. A small pit marks each autozoid. A polychæt worm (Eunicid ?) is a commensal in a burrow on the front of the branches, the large examples of which are about 300 mm. in height and 30 mm. in diameter. Light-coloured varieties are rare and valuable. Two other species—*C. boshuensis*, Kish., and *C. sulcatum*, Kish.—seem to be rare. *C. elatius*, Ridley, on the other hand, is more abundant, and grows to a comparatively enormous size, *viz.* 100 cm. in height, and about 6 cm. in diameter at the base. It is generally red in colour, rarely colourless, and forms one-fifth in weight of the total annual product of Japanese corals. The other forms are *C. konojoi*, Kish., known by the name of "shiro-sango," and of considerable size (30 mm. in diameter), and it has a milk-white skeleton with a small reddish centre; *C. inutile*, Kish., a rare species; and *C. pusillum*, Kish., with a white striated skeleton, and only one example of which has been procured.* The common Japanese coral is readily distinguished from the Mediterranean species by the white centre of the main stem and branches. This was unknown to Prof. Moseley, who refers to what he considers a remarkable carved jewel of Japanese coral, which is marbled white and red, and is characterized by its greater hardness when compared with ordinary precious coral.

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[*] *Vide* Prof. Hickson, 'Nature,' vol. lxxiii. p. 5, 1905.

[†] An allied species has been recently described by Prof. Hickson from the coast of Timor (K. Akad. Wet. Amsterdam, 1905). In this form the sexual organs are carried by the siphonozoids.

The history of the coral fishery in Japan is full of interest, since after the interdict of the Daimyo a coral fisher about seventy years ago secretly carried on his occupation on the Moroto ground with profit, and others followed. After the Meiji Reform in 1868, when the prohibition was removed, about one hundred boats worked on the Moroto ground, and soon exhausted it, so that only a few boats were observed in 1886. But by-and-by coral was discovered on the Tsukinada ground, and in such quantity that nearly all the coral fishers flocked to it. While the centre of the fishery was thus at Tsukinada some fishermen again explored the Moroto ground, formerly so rich, and it was found that the corals had again re-established themselves in such force that no fewer than one thousand boats soon were busy on it, a sight never since seen in the coral fishery of Japan. If any object-lesson could open the eyes of the authorities in our country to the permanence of the food-fishes in the sea, notwithstanding temporary alterations which may or may not be due to man's agency, surely this of the stationary coral of the Japanese seas should.*

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* The foregoing abstract of the Japanese corals is from an interesting paper by Prof. Kishinouye in the 'Journ. of the Imperial Fisheries Bureau,' vol. xiv. 1, Tokyo, 1904.

Besides the foregoing grounds, a new area, the Hizen ground, near the Danjo Islands, was discovered in 1886; the next year eighty boats were at work, and since then the average has been one hundred boats, and this notwithstanding the sudden storms and the calamities characteristic of the region. The newest or Satsuma ground was opened in 1898, near the islands of Taka and Tsukura, and others have been discovered every year near these islands and those further south, so that one hundred boats work on them. It is probable that all the coral banks have not yet been explored, and that the accidental capture of fragments in line-fishing over this great area may lead to further developments.

The Japanese boats used in the coral fishery are, as a rule, ordinary fishing-boats, and they are manned by six to eight men, though this varies in the different villages. The captain is owner, while all share in the captures. Prof. Kishinouye, to whom I am indebted for much of the information on the subject before the publication of Mr. Kitahara's paper, thinks it is a kind of gambling. At first the men used a rectangular net hanging from a piece of bamboo, but lately tufts of old netting are dragged at the lower edge of the net as well as at both ends of the stick. The rectangular net of strong cord breaks off the coral, and the tufts entangle it. The principle is much the same as in the Mediterranean, and as the Japanese ground is rocky it might be an improvement to supplement by heavier bars of wood, though this would undoubtedly add to the labours of the crew. They work with the current, and find it most profitable to sweep the ground with the net from deeper to shallower water; the best months are May, June, and July. Only the Moroto and Kashiwajima banks are within easy reach of shelter, so, as a rule, when signs of rough weather appear, they return to the harbour.†

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* *Vide* 'Resources of the Sea,' pp. 25, 239, &c.

† I am further indebted for information to a paper "On the Coral Fishery of Japan" (Journ. Imperial Fisheries Bureau), by T. Kitahara, 1904.

The coral trade in Japan seems to have been a comparatively recent development, for nearly all the coral ornaments were formerly imported from Italy. Mr. Kitahara shows that the export of coral began to increase about 1896, and culminated in 1900, while the imports suddenly decreased from 1899. The greater part of the Japanese coral goes to Italy, and the minor part to China. The amount for home use is small. The coral exported to Italy is chiefly the "Aka-sango" (*C. japonicum*) and "Momoiro-sango" (*C. elatius*), whilst the latter almost exclusively is sent to China. The "Shiro-sango" (*C. konojoi*) is rarely exported. When first introduced into Naples it sold, notwithstanding its bad colour and somewhat cloudy aspect, for £150 a kilŏgramme, a price which was due to its large size and hardness. Now it is much cheaper.

In Japan it has been used for two or three centuries chiefly as beads for ladies' hair, cords for tobacco-pouches, "inro" rosaries, and inlaid work. The "Momoiro-sango" is highly appreciated, whilst the others are less valued. Mr. Kitahara concludes with the remark equally applicable to the capture of food-fishes as of coral, *viz.*: "It is generally believed that the coral fishery is quite different from other fisheries from an economical standpoint, for the catch can never be known beforehand, as one boat may get nothing for a whole day's work, while another may get several hundred yen worth in one haul on the same bank! This is true to a certain extent, but I believe it is too much to say so decidedly, because the clever, experienced fishermen who can exactly detect the position of the banks, and clearly understand their contour, and can take advantage of the current in using the net, have always a fair catch."

In conclusion, it may be mentioned that the persistence of the red coral of commerce was alluded to in the 'Resources of the Sea' (p. 12), and this notwithstanding man's efforts to destroy it. It has been eagerly sought for many centuries, and has been captured generally without restriction wherever and whenever the *corallini*, or coral-fishermen, listed. Its growth is comparatively slow, and its powers of increase limited. Moreover, fixed to rocks, stones, shells, and dead pieces of coral at the bottom of the sea, it could neither escape the engines of capture nor, by an adult pelagic habit, aid in the spread of its larvæ over a wide area. Its resources for continuing the species under disadvantageous circumstances, caused by the constant efforts of man, are: (1) the facility for branching, and the fact that broken branches retain their vitality and grow on a fresh site, while the fixed portion, if not too much reduced, can send up a new stem; (2) the pelagic nature of the larvæ (true planulæ), which carry to new and suitable sites swarms of the species. Finally, the remarks applied in connection with the sea-fishes are appropriate here, *viz.*: "Nature has been able by her unaided resources to ward off extinction in a species so eagerly desired by man for one of the greatest incentives, *viz.* pecuniary gain, and yet so circumscribed in distribution, and so slenderly supplied with means of dispersion in comparison with many marine animals. Moreover, all this has occurred in a sea specially excluded, from its limited boundaries, from the consideration of the question in the 'Resources of the Sea,' which has been swept by hundreds of boats' crews annually by day and by night. If the continuance of the red coral, therefore, has been assured (for authorities deem the diminished price rather than scarcity of coral at the root of the present depression), what difficulty is there in regard to the permanent abundance of the chief food-fishes of the open seaboard of our country—set as it is in the midst of an almost boundless ocean—with all the marvellous powers of increase (a thousand-fold greater than the coral), so characteristic of them on the one hand, and all the varied and gigantic resources of nature in the sea at command on the other? Science as well as experience answers that there is none."*

* 'Resources of the Sea,' p. 241.

AN OBSERVATIONAL DIARY ON THE NUPTIAL HABITS OF THE BLACKCOCK (*TETRAO TETRIX*) IN SCANDINAVIA AND ENGLAND.

By Edmund Selous.

(Part I. Scandinavia.)

(Continued from vol. xiii., p. 413.)

April 20th.—Starting at 3 a.m., I must have reached the place about 3.30 a.m. There are the usual early cries, and as light begins slowly to struggle through the mists and shadows of the arena I make out four birds through the glasses—"darkly." A little later, one flies off, if indeed it is only that, for he seems to rise straight up into the air, and I see the white tail, as if it were spread.

Now, just as daylight breaks clearly, there is the pause—no bird on the arena—all, I think, must have flown off when that one did; only a rookle, here and there, round about, and that not near. This pause, or rather interval in the birds' activities, after daybreak, seems an actual thing; but perhaps they are then feeding. Then, as the sun begins to top the rocky ridge of the low hill behind me, come rookles and "tchu-whais," so suddenly, one would think there was really a connection. Nothing more happens, however, no bird, since the semi-darkness, has been down on the "moss," nor is now likely to, it being past the time of gathering. It seems strange that there should be this set-back, since yesterday, but, though a splendid fine morning, passing into a cloudless day, it is still colder than yesterday, so that this may account for it. The shooting, too, which goes on all about in the early morning, in defiance of the unenforced game laws, may have something to do with it. No doubt I have come too early, and may have to leave before I shall have seen much. Yet even the little I saw yesterday goes far to show that the general principles governing the courtship of the Blackcock are much the same as those which obtain in the case of the Ruff—that is to say, that the female is won by assiduity, or superior attractions, and not by fighting, or force applied to herself. This hen, for instance, rejected both the birds that courted her, not, in all probability because she was indifferent to such courtship in itself, but simply because she required to be better pleased. She looked, as I say, quite conscious of what the performance meant, and here, as with the Ruffs, and, in my opinion, all female birds (except, perhaps, where the relations of the sexes are reversed), the power seemed to lie in her hands. Probably—or possibly—owing to the earliness of the season, the feelings of neither sex are yet sufficiently advanced for pairing to take place.

April 21st.—Arrive at the usual time. From the "tchu-whai-ing" and the soft "choc-kerada"—that plaintive note of war—some birds it seems, are on the ground, and now, in flashes through the gloom, the white tail of one, here and there, and then its coal-black body appears. But, as the day breaks, all is silent, and not a bird visible. Nor do any come down again. It is another blank morning.

April 24th.—On the ground at 3.20 a.m., but nothing to record.

April 25th.—On arriving at near 5 a.m., I found several cocks on the ground, which made me regret not having come earlier—for I like to see things from their first beginnings. There was, now, more flying, for short distances, over the ground, and again alighting. This indeed was a feature, and, as the birds flew, they often uttered a deep note—"tchu-u-u"—which had a warning and threatening character. They did not, however, leap into the air. The war-dance, or frenzy, even in its incipient stage, was wanting.

A hen now flew into a small tree, close to where the cocks were, and I then saw that there were two more hens there on the ground. There was now some courtship, but it was of a very sluggish nature, nor did the presence of the hens have any marked effect upon the cocks, in regard to each other. There had been no fighting before, and there was none now, though, of course, there is always an idea of it. It is, so to speak, in the air, but does not—that is to say, I have not yet seen it—

come off. Two birds did, indeed, advance, in a slow way, and stand front to front, with their heads down, but nothing came of it; they did not make a pass. The little actual fighting which I have hitherto seen, and which has amounted to a few half-hearted passes and jumps against one another, has been when no hens were present. Such courting of the hens as now took place was the same as on previous occasions. The cock walked beside, or round, the hen, tilting himself in the way I have described, but springing, or "dancing," made no part of such display. The flying about the ground, indeed, was continued, on and off, by the cocks, the hens—some three or four in number—being also there; but it did not seem specially addressed to them. On the contrary, whenever a cock went specially to a hen there was nothing of it.

After awhile, another hen flew first into a small tree in the vicinity, then into the arena, and, later, another flew from there into such a tree, where she sat looking about. Things seemed only, as yet, beginning, and everything pointed to an interesting morning's observations, when, from the ridge where I generally watch, a shot was fired, and all, of course, was at an end. Happily no bird was hit—at least none seemed to be. It was a long stupid shot, having no other effect than to put an end to the interesting scene I was watching. There is no one to enforce the game-laws here and, for aught I know, it is the same all over Sweden. Owing to there having been nothing, day after day, I had come later than usual, and, finding the birds on the ground, sat down, without crossing it, in a place from which I had, perhaps, a better view. Had I been on the ridge, however, the shot might not have been fired. These are the kind of things that make the true field naturalist hate a gun; the bang of it, too, vulgarises everything—all poetry goes out of nature.

All now was over, for though the birds showed a good deal of disposition, in another half-hour, to resume their courtship, yet the shot had made them wild and unsettled. They flew about, both males and females, settling in different trees, rookling and "tchu-whai-ing," and one or two came down, here and there, but soon flew up again. One settled in a small fir, some twenty paces from where I sat, and rookled. The note commences with a "kroo, kroo, kroo," or "roo, roo, roo," and then comes the full "give him his coppers, &c." To produce the sound, the bird lowers its head a little, and the throat is swelled, and reduced, and again swelled, on the bellows principle of alternate inflation and exhaustion, as I suppose. This gives it a curious undulatory appearance. When the fierce "tchu-whai" note is uttered—that is to say, just before it is—the Blackcock rears up with a little jerk, and gives a menacing flap—or it has that appearance—with its wings. Then comes the note, as does the trumpet of the Pheasant or the crow of the Cock. As the wings are flapped, their white under surface is revealed.

A hen also flew into a tree, equally near, and another into one not much farther off. Birds were all about, but their business of the morning had been murdered by that shot, and so had my observations. One cock came down, and jumped about a little by himself—a fly and then a spring or two—and this was the nearest approach to the "war-dance" that there was.

That I have come early seems evident. Just as I have to go, perhaps, things may be in full swing. Still I shall have seen the early stages, and in studying these nuptial activities, with a view to throwing light on their meaning and origin, this is important. Nothing that I have yet seen leads me to suppose that the courtship and pairing of the Blackcock differs, materially, from that of the Ruff. In this stage, indeed, I can say little, or nothing, in regard to any selection that may be exercised by the hen, but she has at least shown no signs of that passive surrender which naturalists who are opposed to the doctrine of sexual selection talk about. The fact that the cock, whatever he may do hereafter, is, at present, courting the hen after the ordinary manner of our own and other Pheasants, and not with that extraordinary dancing, or rather leaping, pantomime which, later, he seems to develop, is important, for a doubt is thereby raised whether he employs it for strictly courting purposes at all. If not, then, whatever he does employ it for, the question of sexual selection is not affected by it—except indirectly, and, in that way, perhaps, most importantly. In courting the hen, *now*, the male Blackcock comes close up to, and walks about her, precisely as the Pheasant does. On that occasion when I saw the "dance" performed, about the middle of May, in

Norway, no hen bird was visible,* and here, during its weak beginnings, the cocks were almost certainly by themselves. In the "dance," although the Blackcock certainly cuts a very extraordinary figure, yet there is no scientific exhibition of his plumage, bringing out all the points. He merely looks a frantic bird. It is also significant that, as I saw it performed in Norway, angry sounds, more or less answering to the "tchu-whai," which seems to be the note of challenge of one male to another, were all the while uttered; whereas the courting display proper, as I have yet seen it, is made in silence.

April 27th.—Almost a blank morning. Two birds only, after whirbling at one another from adjoining trees, for a long time, till quite late, past 7 a.m., flew down at last, not upon the arena, but amidst the scrub of undergrown fir-trees, skirting it. Here I could see them seeking for and advancing upon one another, and once they fought very slightly—over almost immediately. After this, they remained on the ground for some time, and then flew into the small trees.

April 29th.—On spot at 3.30 a.m. Rookling, &c., is all about, and I hear sounds—unmistakable, I think—as of birds fighting, in the darkness. With this comes the "choc-kerada," "choc, choc, kerade," that plaintive invitation to battle—though, as I say, of real battle I have seen nothing yet—also the prolonged "chorrrrrrrr" made by the cocks when they fly from place to place over the ground. Hens are also about, but I can see little, there is a mist on the ground, and it soon begins to rain. Not a bird to be seen, now, as it lightens. The fine rain may keep them away, but otherwise it is mild—comparatively warm, indeed.

At last a bird flies down, and then another, in different parts of the "moss." For some time they rookle, "tchu-whai," and fly about the ground; this last, however, being only at intervals. That they are defiant of each other is plainly evident, yet they keep their places, approximately, being at least fifty yards apart. A hen now flies into a small Scotch fir, somewhere between the two, and, shortly afterwards, down to one of them, alighting within a few yards of him. He immediately walks up to her and begins to court her. This he does in the way I have described before, but with this addition, or rather amplification—there is no new feature—*viz.*, that, having passed by her from behind, he continues to walk away, then turns, comes back, and does the same thing. It is evident that the hen has only to look in the direction in which he is walking, each time, after leaving her (*i. e.* straight before her), to have a full view of the white tail, which is displayed now to the best advantage. This was the principal point of interest. That every beauty of the plumage is well shown to the female seems now evident, but the spectacle of the courtship was a good deal spoilt, for me, by my being often unable to see the hen, her sober brown body—which is also smaller than the male's—getting hidden amongst the tufts of the heather; whenever I located her, however, as I did every now and then, she was situated as indicated by the cock's actions, and, once or twice, walking behind him, as he thus paced away from her, for she did not keep still. No further point of intimacy, however, was reached, and, after awhile, the hen flew away.

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* None could have been near, for the "lek" was a lichen-covered granite surface, without cover.

The conduct of the hen, therefore, this morning, was this. She first flies into a small fir-tree—not more than a shrub—growing amidst the heather of the assembly-ground, where the two defiant rivals are waiting, and midway between them. Then she flies to one of them, by whom she is courted, receives his attentions, but is not overpowered by them, and leaves. This is not what I understand by playing a passive part. On the contrary, she shows an active interest, though reserving her decision, and there is no indication of her being at either of the males' disposal. The power of invitation, permission, and veto, seems to lie with her; which reminds me that I have never yet heard it explained by those who have faith in the "indifference" of the female birds, why she comes to this particular class of assembly at all.

After the hen's departure, the two cocks continue to vaunt themselves, as before, but the martial spirit of the one that has been tentatively selected seems risen, in consequence, and, in a series of little flights, over the ground, and advances, upon it, he enters the territory of the other, who moves to meet him, in a similar spirit. The spectacle is now one of two timid boxers pretending to be brave. Both seem about to leap, but draw back, in the moment of doing so. They are about to grapple, but do not grapple, to spar, but refrain from sparring. At last, fronting one another, with hardly six inches between them, they rookle in the most absurd manner, repeating the whole sentence, time after time, as though they were sitting in trees. It was really a ludicrous scene; yet, once, the bird whose territory had been invaded did really attack the other, taking him, I fancy, by surprise. But it was "like the lightning in the collied night," over almost before one can say "it lightens." After this, both cooled rapidly, and, before long, the invading bird went back to his own part of the arena, where he remained, for some little while, and then flew up into a tree. The other did not remain much longer, and though the morning is now fair, and not nearly so cold as it has been, the arena, at 6 o'clock, still remains empty.

It would seem, from this, that, like the Ruffs, each male Blackcock has his particular domain on the assembly-ground, though the size of this is in proportion to the much greater space of the whole. On the other mornings, too, the same birds, as I now make no doubt they are, have flown down into approximately the same areas. Yet it was a very different scene when my observations were interrupted by that shot, for then, in a small space, some half-dozen cocks were courting nearly as many hens. It is difficult to say why, most unluckily, on that particular morning, the coming-on disposition should have been so much more marked.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Bechstein's Bat (Myotis bechsteini) in the Isle of Wight.—I write by request of Mr. Percy Wadham, the well-known naturalist of Newport, to ask you to make this record. He caught two specimens of this Bat during the months of July and August last in a small copse of oak and fir, within one hundred yards of his own house. The first he killed with a stroke of his butterfly-net; the second he caught in the net and kept alive for some days. His friend Mr. Jeffery, taxidermist, of the same town, should have the credit of being the first to suppose that they were a rare species, and when Mr. Wadham sent me the female I was able to identify it without any doubt, being well acquainted with its nearest relatives. Mr. Jeffery took the following measurements of the female: Length of head and body, 1·75 in.; length of tail, 1·45 in.; length of ear, $\frac{7}{8}$ in. The male was somewhat larger. At first sight one would call this Bat "long-eared," though its ears are not nearly so long as in the species of that name; they are decidedly longer than in *nattereri*, *daubentoni*, and *mystacinus*. Hampshire claimed for many years to be the only British home of this species, but Millais records its occurrence in Oxfordshire, and Mr. Heneage Cocks in Berkshire (Zool. 1909, p. 154).—J. E. KELSALL (New Milton, Hants).

Artifices by Cat to secure its Prey.—It is well known that Stoats and Weasels will occasionally fascinate and cause their prey to approach by performing strange and unusual antics which have the effect of lulling suspicion and arousing the curiosity so highly developed in many wild animals. This peculiar habit has been described in detail and illustrated by Mr. J. G. Millais in his 'Mammals of Great Britain,' vol. ii. pp. 116 and 132. Possibly it is less commonly known that a similar device is employed by domesticated Cats, from which it may perhaps be inferred that wild members (*Felidæ*) also make use of this artifice. This is illustrated by the following observations made by the writer in Berwickshire:—During some very severe and snowy weather food for wild Pheasants was placed outside and close to a small covert about seventy yards from the house, and overlooked by several windows. More than twenty birds took advantage of this, and continued to visit the spot in the early mornings even after the snow had entirely disappeared. A cinder-covered pathway runs through the grass not far from the feeding-place, and on this one morning was seen a black Cat surrounded by Pheasants—both cocks and hens—some of which occasionally approached to within two or three feet. All the birds—twenty-seven of which were counted at one time, this being a greater number than had been previously seen together—were watching the Cat with evidently the highest interest, stepping round and gradually drawing nearer and nearer. The object of their scrutiny lay quietly crouching on the ground, now and again turning over on her back and rolling from side to side, her paws and tail waving in the air. Then a sudden spring would be made at the nearest bird, but this meeting with no success caused only temporary alarm, and she was very soon once more as closely surrounded. This manœuvre was several times repeated, the whole performance lasting altogether about half an hour after it was first observed. By this time the Cat had evidently tired of her unsuccessful attempts, and walked away quietly up the grassy slope, finally disappearing into the covert, still followed by a straggling line of fascinated Pheasants, a picture vividly suggesting a new version of the "Pied Piper." It may be mentioned that the Cat in question was quite young, which may account for the absence of fatal results for the intended victims, supposing that the game itself did not provide sufficient charm and fascination. I am told that a Cat had been previously observed near the same place, and apparently being mobbed by a number of Pheasants, but no special notice was taken at the time of the occurrence. The hunting Cat is very generally considered one of the most destructive of the varied animals included in the list labelled "Vermin," and the habit described above seems to record another black mark against an already damaged character.—D. M. A. Bate (Bassendean House, Gordon, Berwickshire).

The Queensland Dugong (Halicore sp.).* — Queensland differs from the other Australian States in having a rich and picturesque tropical region, with a coast-line of fifteen hundred miles. Amongst the inhabitants of Queensland waters the Dugong is the most remarkable. It has died out of, or been killed off in, almost every other part of the world, and if something protecting and encouraging be not done the time is approaching when even the Australian tropics will fail to yield a specimen. It once abounded along the northern and north-eastern coasts. Sixty years ago it was hunted by the white man for sport; fifty years ago a belief in the curative properties of its oil was propagated, and sport and money-making were combined. All the time and for ages before it was killed by the aborigines, and eaten as a choice article of food. It would have been extinct, or almost extinct, before now had not the Queensland Government legislated to protect it during certain seasons. The Dugong wears a weird, misshapen look when seen in the shallow coastal waters, or on the grass-grown bottoms at the mouths of rivers entering the sea. The absence of hind limbs creates an impression of deformity, an impression which is deepened by the apparent helplessness of the frail flippers. The animal bulks largely in comparison with the living things ordinarily seen in its vicinity. It sometimes reaches 12 ft. or 16 ft. in length, and weighs between 10 and 12 cwt. Eight or ten feet is a common size, and 4 to 5 cwt. a medium weight. Its movements are laboured and sluggish. It crushes the short reeds with its broad molars. In the male the incisors become the formidable tusks. The blacks and some whites tell stories of the Dugong climbing on to the land and browsing along river-banks in the moonlight. Uncanny incidents attach to these legends, but though seemingly corroborative details are forthcoming, the stories must remain in the category of myths. The sluggish beasts have quite enough to do to make a living in their native element without adventuring on the mainland or on dry land anywhere. And if they were set down any distance from the water their frail flippers would be weak supports for the journey back. In the stories, however, there is sometimes an element of romance. The affection of the female Dugong for its young is raised by some to the rank of a special virtue. Many examples of what looks like affection are certainly forthcoming, but as often as not the cow and bull Dugong make off when danger threatens, leaving the calf to extricate itself as best it can. Seldom do they exhibit any of the blind fury of the mother Whale in similar circumstances. The mother Dugong may for a little time hang about well out of reach of harm in expectation that the calf will come along, but the wound of severance heals quickly, and browsing is renewed with freshened appetite. Occasions occur when mother and calf appear inseparable, the mother staying alongside the harpooned calf till she also has been harpooned. But such incidents are not frequent, and when they occur there are grounds for attributing the mother's conduct to dulness of apprehension rather than to affection. There are authenticated cases, however, of a mother following a captured calf a long distance, and her bleats of complaint, as well as the appeal in her eyes, have affected the fishermen's nerves. Natives of the Malay Islands make a decoction of Dugong juices, which they term "Dugong's tears," and sell as love charms, thus indicating a Malay belief in the tenderness of the animal's affection. Thirty years ago Queensland looked to the Dugong as a coming source of national wealth. Great herds of them abounded in the waters off the northern coast, and occasionally spread as far down as Moreton Bay. Fisheries were established on a considerable scale. Companies for boiling down and canning Dugong were started at Wilde Bay and Hervey's Bay under encouraging auspices, but through a number of preventible causes the industry was allowed to languish. Dugong bacon may be purchased in a few shops along the Queensland coast. The blacks like it, and when prepared in a fashion of their own the Chinese are fond of it. The fresh meat, roasted or grilled, is acceptable to most men if they are hungry. It tastes like pork, but with a fishy flavour. Of course the way it is prepared has a lot to do with its acceptableness as food. Many people along the coast, when Dugong was commonly sold, have eaten it for pork without suspicion. The common method of preparation is to fry it in its own oil or salt, and preserve it as hams or bacon. The curative properties of the oil were first brought before the world about the year 1855. The therapeutic effects were glowingly described. The oil was classed as "emollient and solvent." Dr. Hobbs, Health Officer at Moreton Bay, wrote:—"In its pure state it may be taken into the most sensitive stomach. It is sweet and palatable. As a restorative remedy it may be taken as food, and many ounces consumed almost imperceptibly every day, thus furnishing the system with the requisite amount of carbon for its daily oxidation." He and other Queensland medical men employed it in practice, and for a time all Australia regarded it as a medical boon. Fishing stations were formed at St. Helena; samples of oil and meat were sent abroad, and medals and other recognitions won at various exhibitions. Extract of Dugong is sold at present by Sydney chemists in the forms of oil, lard, and ointment, and a London West End physician is now using the oil in his practice.—THE LONDON CORRESPONDENT OF THE 'NORTH QUEENSLAND HERALD' (70A, Basinghall Street, E.C.).

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* According to Mr. Lydekker, "although it has been considered that the Dugong of the Red Sea and also the one found on the Australian coasts are specifically distinct from the Indian Dugong (*Halicore dugong*), this is extremely doubtful."—Ed.

AVES.

Crossbills (Loxia curvirostra) in Hants.—Several intelligent observers have met with these birds recently (December, 1909) on the south side of the New Forest.—J. E. KELSALL (New Milton, Hants).

Lapland Bunting near Great Yarmouth.—On Oct. 15th, 1909, in the vicinity of Yarmouth, a Lapland Bunting (*Calcarius lapponicus*) was taken alive by means of a clap-net. Two others have also been reported.—B. DYE (Great Yarmouth).

The Honey-Buzzard near Yarmouth.—The Honey-Buzzard (*Pernis apivorus*) has again appeared in one at least of the Eastern Counties. A specimen was obtained in the second week in October, 1909, at Haddiscoe, about seven miles south-west of Great Yarmouth. It is now in the possession of our local taxidermist, Mr. W. Lowne, who informs me that the prevailing colour of the bird is light umber-brown, and differs considerably from the dark varieties obtained in the autumn of last year.—B. DYE (Great Yarmouth).

Black-tailed Godwits in Co. Cork.—It may interest some readers of 'The Zoologist' to learn that in December, 1908, a small flock of Black-tailed Godwits (*Limosa belgica*) visited Cork Harbour (about nine or ten birds), and were seen on the mud-banks off Blackrock, where my friend Mr. W. B. Barrington shot a fine specimen. And this season another small flock visited our south coast, one being shot near Youghal Harbour, and Mr. Barrington had the pleasure, in October, of seeing about a dozen birds on the very same mud-banks off Blackrock where he had observed them previously. One of this flock was obtained by a friend of his, and the flock was afterwards seen on several occasions feeding on the banks. These birds are of very rare occurrence on our west coast, and although regularly punt-shooting on the Moy Estuary, Killala Bay, from 1858 up to 1908, only three or four individuals have come under my notice, and only one specimen shot by me, near Bartragh on March 6th, 1876. But I have heard of two others being shot, and have seen the birds; one was shot on the tidal part of the Moy in May, 1863, and was nearly in perfect summer plumage, and another on Sept. 3rd, 1881. In every instance, except the pair I saw in June, 1878 (which were in summer plumage), all were solitary birds in company of Bar-tailed Godwits. —ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

The Sir Henry Boynton Collection of Birds: a Valuable Addition to the Hull Museum.—Through the kindness of Mr. and Mrs. Wickham Boynton, the collection of birds formed by the late Sir Henry Boynton, which for many years has been exhibited in the large room at Burton Agnes Hall, has been placed in the Municipal Museum at Hull. As all ornithologists are aware, Sir Henry's collection of birds, principally obtained by his own gun, was one of unusual interest and importance, and contains many great rarities. There are over two hundred cases in all, and besides being valuable by reason of the scarcity of the specimens, the collection is interesting from the fact that in many cases both sexes of birds are represented, and in some instances there are also the young. Each case has been exceedingly well set up, and the whole forms a collection such as is rarely seen together. In addition to this the Hull Museum has also recently acquired the collection of birds (about seventy cases) formed by Mr. Riley Fortune, F.Z.S., the well-known ornithologist. This latter consists principally of Yorkshire specimens, and fortunately serves well to fill in the gaps in the Sir Henry Boynton Collection. These, together with the Pease Collection already in the Museum, will enable the authorities at Hull to have a display of birds such as will be difficult to beat in any Northern Museum.

PISCES.

The Queensland "Barramundi."—The northern rivers of Queensland have a first-class fresh-water sporting fish, the Giant Perch, popularly known as the "Barramundi" (*Lates calcarifer*). This fish attains a length of four to five feet, and a weight of over sixty pounds. This fine fish, known in India as the Cock-up or Nair-fish, occurs also in China, and has been seen in the Singapore fish-market. In aspect and habits of feeding the "Barramundi" suggests the English Bass. So greatly is this fish esteemed for the table that regular supplies are now being despatched to Sydney from Queensland, where tons weight are being disposed of from 6*d*. to 8*d*. per lb. THE LONDON CORRESPONDENT OF THE 'NORTH QUEENSLAND HERALD' (70A, Basinghall Street, E.C.).

OBITUARY.

DR. RICHARD BOWDLER SHARPE, LL.D.

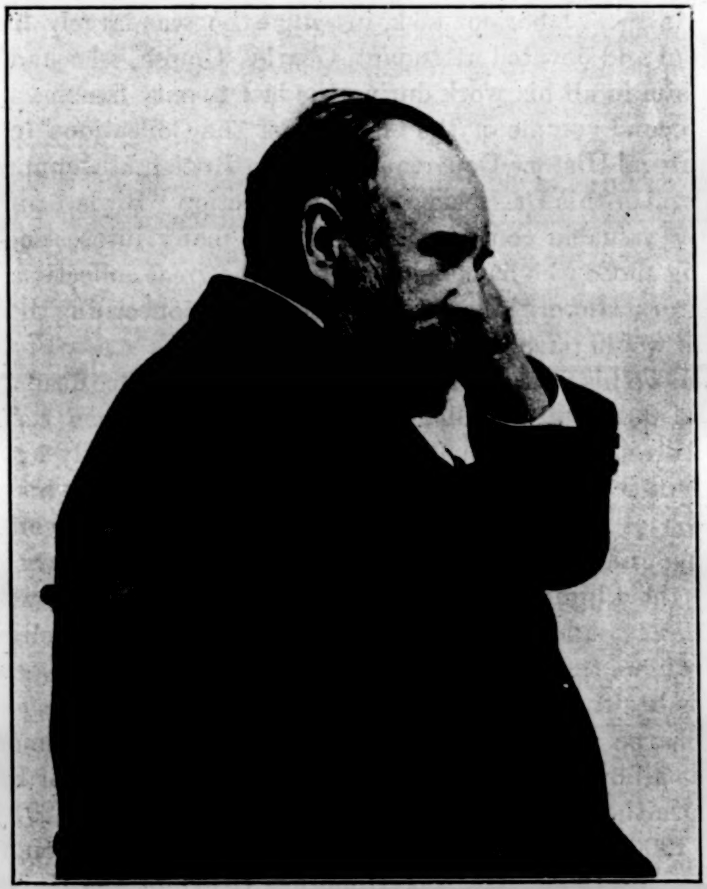
THE announcement of the death of Dr. RICHARD BOWDLER SHARPE, at the age of sixty-two, will cause the greatest regret among the wide circle of his friends and admirers in all parts of the world; but his loss will be more especially felt and mourned by ornithologists, for they can best appreciate his great talents and extraordinary knowledge of Birds. On December 16th he attended the monthly dinner and meeting of the British Ornithologists' Club, which he founded in 1892, and was then in his usual health and good spirits, but while returning to his house at Chiswick he appears to have contracted a severe chill, which rapidly developed into pleuro-pneumonia, and ended fatally on December 25th.

He was born on November 22nd, 1847, and was the eldest son of the late Thomas Bowdler Sharpe, well known as the publisher of 'Sharpe's London Magazine.' He early displayed a great taste for natural history, more especially for birds and insects, and as a boy spent much of his time in the company of William Briggs, a naturalist of considerable skill, who helped him to form a collection of mounted British Birds, which was eventually presented to the British Museum.

He was educated at Peterborough (King's Scholar) and Loughborough Grammar Schools, and subsequently entered the publishing-house of Messrs. W. H. Smith & Son in 1863, and worked for a time with the late Mr. Bernard Quaritch. In 1867 he was appointed Librarian to the Zoological Society of London, and retained that post until 1872. On the death of George Robert Gray he entered the service of the Trustees of the British Museum, and was appointed Senior Assistant in the Department of Zoology on September 11th, 1872, a post which he retained till November, 1895, when he was promoted to be Assistant-Keeper in charge of the Vertebrate Section.

While Librarian to the Zoological Society he began to publish some of his work, including a catalogue of his private collection of African Birds and his splendid 'Monograph of the Kingfishers,' a work which at once established his reputation as an ornithologist of exceptional ability. He also conceived, and in partnership with Mr. H. E. Dresser commenced to publish, a great serial work on the 'Birds of Europe,' but after fifteen parts had been issued he was obliged, owing to other important engagements, to relinquish his share of the work, and the remaining parts were completed by Mr. Dresser alone. Shortly after his appointment to the British Museum he commenced to write the great work of his life, 'The Catalogue of the Birds in the British Museum.'

No one of the present generation who visits the Bird Room at the Natural History Museum can have any conception of the difficulties under which work was carried on in the old days at the British Museum, the underground dungeons which were used as workrooms being not only very small but very insufficiently lighted. The first volume of this Catalogue, containing the Birds of Prey, was completed and published by the Trustees in 1874, and the whole work, contained in twenty-seven thick octavo volumes, took twenty-four years to finish, having been only completed in 1895. Eleven different specialists took part in this mighty undertaking; Dr. Sharpe himself contributed no fewer than eleven whole volumes and portions of three others, and edited or assisted in the preparation of the remainder, a feat of which he was justly proud. During these years he also found time to publish a number of important works, such as his 'Monograph of the Swallows' (commenced with Mr. C. W. Wyatt), and to complete the 'Birds of Asia,' 'Birds of New Guinea,' and 'Monograph of the Humming-Birds,' three great folio works by Gould, which had been left unfinished at the time of his death. He also contributed numbers of important memoirs and papers to various scientific periodicals, more especially to the 'Ibis,' 'Proceedings' of the Zoological Society, and 'Journal' of the Linnean Society.



In 1884 Dr. Sharpe was sent to India to superintend the package and transport of the great collection of Indian birds and mammals which had been presented to the British Museum by Mr. A. O. Hume. During his absence the writer was placed in charge of the Bird Room, and since that date had been closely associated with Dr. Sharpe up to the time of his death, and had co-operated with him in forming the now unrivalled collection of Birds and Eggs at the Natural History Museum.

Between 1899 and 1909 he compiled a 'Hand-List of the Genera and Species of Birds,' which was published by the Trustees in five volumes, a most laborious task, in which he was largely helped by his faithful and devoted attendant, Charles Chubb, who had so ably assisted him in all his work during the last twenty-five years.

The second volume of the 'History of the Collections' contained in the Natural History Departments of the British Museum appeared in 1906, and of this Dr. Sharpe wrote the Section "Birds," pp. 79–515. This very valuable contribution contains many interesting details respecting those who have helped to form the great collection of Birds in the Natural History Museum, and particulars concerning them which otherwise would have been lost and forgotten, as many of the facts were based on his personal knowledge of men long since dead and gone. With the death of Dr. Sharpe a link is lost between the modern school of ornithologists and the little band who originally founded the British Ornithologists' Union. He knew them all, and his personal reminiscences extending over more than forty years were always interesting and often most entertaining. His extraordinary memory, which enabled him to name collections of birds off-hand with tolerable accuracy, and by merely glancing over them to tell approximately where they came from, was truly remarkable, especially before his health began to fail.

Dr. Sharpe was immensely popular, and justly so, among ornithologists all over the world, and was elected President of Section A at the Ornithologists' Congress held at Budapest in 1891, and at Paris in 1900; he was also elected President when the Congress met in London in 1905. He was Honorary LL.D. of the University of Aberdeen, a Fellow of the Linnean and Zoological Societies, a Member of the British Ornithologists' Union, and a recipient of the Gold Medal for Science bestowed in 1891 by H.I.M. the Emperor of Austria.

W. R. Ogilvie-Grant.

NOTICES OF NEW BOOKS.

Man and Nature on Tidal Waters. By ARTHUR H. PATTERSON. Methuen & Co.

THIS is the fourth volume written by Mr. Patterson on the fauna of his native district which he knows so well; in fact, he has now become the natural historian of East Norfolk. The present volume, however, differs from its predecessors in being mainly devoted to reminiscences of those humble folk who, though born naturalists and sportsmen, know it not, and choose to acquire a barely living wage by occupations which link them with nature and the pursuit and familiarity of animal life. These somewhat primitive and peculiar people, who might well be called *Homo breydonensis,* are in many pursuits fast dying out, their occupation gone, and the survivors themselves almost relegated to the "scrap-heap." Mr. Patterson has had a long personal experience of this hardy Yarmouth race—smelters, shrimpers, eel-fishers, gunners, mussel-dredgers, trawlers, and mackerel and herring catchers—and his reminiscences of them, and the statements he has obtained from them make this book a very "human document." Interspersed with the yarns of these delightful waifs and strays—who belong to the environment as much as the other animal life—are many bionomical observations of both bird and fish, told with that simplicity of fact which only long familiarity inspires. How much more of this first-hand knowledge is probably buried with these rough naturalists who neither understood themselves nor were recognized by others!

Mr. Patterson has done his work well; if this volume is perhaps the least purely zoological of his series, in a literary sense it is by far the best. We commenced his book in the early evening; it held us, and we went to bed that night far beyond our usual hour. We know these tidal waters well; fifty years ago we first handled a gun, and that on Breydon; and though for many years the wild district has become to us only as a memory, these pages have reproduced the old scenes, the animal life and the old human characteristics. It is not every writer who can do this with success: Mr. Patterson's books are as representative of Yarmouth as is the Herring.

Indian Insect Life; a Manual of the Insects of the Plains (Tropical India). By H. MAXWELL-LEFROY, M.A., F.Z.S., &c. Assisted by F. M. HOWLETT, B.A., &c. W. Thacker & Co.

THIS massive volume marks the untiring energy of Mr. Maxwell-Lefroy, the chief entomologist of the well-known Agricultural Research Institute at Pusa, Bengal. Many beautiful publications have served to illustrate some of the gorgeous insects of India, but this is the first work to treat the subject with any degree of completeness, so far as all orders are concerned. The volumes devoted to the Insecta, in the series relating to the "Fauna of British India," will naturally, when completed, form a "last word" to date, but their complete appearance will not be for some years. In this volume we must not expect infallibility in the extensive field surveyed by Mr. Lefroy, but we do in these pages discover the best introduction to the subject, very much original information, and a distinct and valuable addition to Oriental entomology.

As regards "Instinct and Habit," the author's views appear to lean to the Cartesian estimate, and as being more or less automatic. On the subject of classification, that vexed controversy in which proposals are defended as axioms by their proposers, we quite agree with the remark of Mr. Lefroy, that "the most diverse views prevail, and there is no standard classification that is or can be universally employed, even if it be admittedly not academically accurate, but sufficiently so for practical purposes." If this is true of taxonomy, what may not be said of some theoretical conclusions? and we are not at all surprised, nay thankful, that on the subject of "Mimicry" we read:—"The sincere student with a profound faith in human nature may be cautioned against accepting any conclusions or facts not based on observation of insects in their natural conditions; the search for explanations of insect-colouring has almost rendered the whole subject ridiculous, since conclusions have been drawn from museum specimens, which have no relation to the lives of insects."

The excellent illustrations in this volume are mainly contributed by the artist staff of the Pusa Institute, artists who are natives of India, trained in art schools of that country; in fact, the whole volume is the work of, and a credit to, the press of our Indian Empire.

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